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EDITORIAL DEPARTMENT NOTE

In line with the policy of bringing to N. A. C. A. members through the *Bulletin* articles of current interest bearing on the industrial accounting problems arising from the war, there is presented in this issue articles dealing with two subjects of considerable current interest. Today, with the expansion of production, the taking on of new products and the need for accurate time allowances in connection with bidding on government products, time and motion study is assuming increasing importance to industrial accountants. Mr. Werolin's article provides a completely up-to-date picture of this field. With the advent of war, new importance has been given to the question of what to do with old business records. Those companies which have not developed a definite policy with respect to the retention and disposition of records will find increased incentive to do so under present conditions, while those companies which have developed policies and procedures will find the present a good time to review and possibly revise their plans. The article by Mr. Davis will provide guidance in this area.

The author of our first article, A. E. Werolin, after graduating from New York University, attended Yale University where he received the M.S. and M.E. degrees. Until 1935 he engaged in industrial engineering; since that date he has been active in the professional engineering field and is at present a Partner of McKinsey & Co. Mr. Werolin has specialized in time and motion studies, method engineering, wage incentive plans, plant layouts and cost control.

Ernest A. Davis, the author of our second article, is a graduate of LaSalle Institute. His early business experience was obtained as Office Manager of the Bridgeport office of the Burroughs Adding Machine Co. from 1927 to 1931. Since the later date he has been connected with the Pitney-Bowes Meter Co. of Stamford, Conn., where he is now serving in the executive capacity of Branch Auditor. Mr. Davis is a charter member of the Greenwich Chapter and is now serving as Chapter President.

Articles published in the *Bulletin* present many different viewpoints. In publishing them the Association is not sponsoring the views expressed, but is endeavoring to provide for its members material which will be helpful and stimulating. Constructive comments are welcomed and will be published in the Forum Section of the *Bulletin*.

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MAY 15, 1942

THE COST ACCOUNTANT AND TIME AND MOTION STUDIES

By A. E. Werolin, Partner,
McKinsey & Co., New York, N. Y.

THE ANALYSIS of manual operations has been an accepted procedure for over fifty years, but despite this fact there is considerable confusion regarding the meaning and objectives of "motion study" and "time study." Inconsistencies in the methods employed, and frequent assurances that these particular analyses represent the panacea for all manufacturing problems have resulted in many divergent opinions regarding their efficacy and, also, in equally as many disparaging results.

Much of the confusion has resulted because a large number of terms have been devised and are used to describe certain phases of motion and time studies, such as: methods study, work simplification, production study, micro-motion study, process study, and several others. Their individual meanings and relationships to motion and time studies have not always been made clear. In addition, revolutionary techniques and equipment—a true indication of advancement—have appeared with such rapidity that it is becoming increasingly important for a technician or expert to give careful thought to their use and application.

Furthermore, and unfortunately, practices of an unethical sort have trickled into this field, arousing suspicion and distrust—retarding the real and honest purposes of motion and time study work—and making it difficult to apply the simple and straightforward thinking so urgently demanded.

Stated simply, motion study is "the observation of an operation to see how it is done, in order to improve it." This entails studying the motions used in any work with the expressed objective of discovering an improved way of performing the operation. Time study can be defined as "the measurement of the time required to perform an operation."

This essentially describes what the technician should propose to undertake in making motion and time studies. You will notice that these analyses are mentioned in reverse order from that commonly used because logically these studies are made in this order:

(1) motion study and (2) time study. Of the two, motion study is the more important, for only after the correct motions have been developed and put into use is it practical to follow with a time study.

Objectives and Definitions

(a) Motion Study

The question is often asked about motion study: "What does this type of analysis accomplish?"

It results in:

1. INCREASED PRODUCTIVITY: By the elimination of unnecessary, poorly-devised and ineffective motions.

2. REDUCTION OF FATIGUE: By shortening the necessary motions and by proper designing of working area, equipment and tools.

3. INCREASED SAFETY: By reducing fatigue and creating correct work habits and uniform rhythm in the work cycle—this is a natural result.

4. IMPROVED QUALITY: By setting up standardized manufacturing methods.

(b) Time Study

What about time study? What are its purposes?

A scientifically made time study seeks to arrive at a standard time or standard rate of production which may be used as a basis for:

1. Accurate labor costs and other cost standards.

2. Estimating prices.

3. Production control.

4. Wage payment—as a basis for some type of incentive or bonus plan.

The roads that lead to these results have varied; scopes have widened; techniques have improved, and more accurate equipment employed. Fundamentally, however, the objectives have not changed.

(c) Other Terms

We often hear new and startling terms in this field, and occasionally even their meanings differ. In general, the following definitions apply:

1. METHODS STUDY—this term includes motion and time study work, but it is a much broader phase of industrial engineering in that it considers, before undertaking a detailed motion study, the flow of work through a plant, or office, and each department. The processes involved, the layout of equipment, the planning and scheduling routine, the types of materials and equipment used, and other related factors are also studied in this approach.

2. OVER-ALL MOTION STUDY—this covers motion study applied either to the entire process or to a series of operations. "Process Study" is another term for this type of analysis.

3. WORK SIMPLIFICATION—this term is commonly used with reference to over-all motion study, though as currently practiced a great deal of emphasis is placed on foreman and employee training in the principles of motion economy and in the micro-motion techniques.

4. MICRO-MOTION STUDY—this term applies to the use of a motion picture camera for making detailed motion studies, which result in a graphic visualization of both motions and time.

Place in Organization

In many companies the function and purposes of motion and time study work were never clearly defined or appraised, and it is frequently found that the time and motion study department is poorly staffed and more or less plays the role of an orphan. It is not uncommon to discover such departments under the supervision of the cost department, controller, treasurer or personnel manager. If we believe that this study has real value, why not give it an important place in the manufacturing organization, along with the necessary complement of trained personnel? Not only is it of utmost importance to have trained men, but much emphasis must be placed on the type of men. Their work will continually bring them in contact with all of those engaged in the manufacturing process; they must make recommendations; there will be disputes to settle. How effectively this work is done is reflected in

the attitude and general tone of the shop. If the department has prestige and authority, and the right kind of technicians, then the employee's attitude will be one of confidence and respect.

In a plant that is properly organized, the head of the time and motion study department should be directly responsible to the highest ranking production executive. He should be trained to cover all phases of industrial engineering, and should have a sufficient background of cost and accounting theory in order to work closely with the cost accountant of his company.

The major responsibilities of the motion and time study department should be:

1. Study motions, methods, processes, and equipment.
2. Study plant and departmental layout.
3. Establish and maintain time standards.
4. Assist in setting up and operating wage plans.
5. Analyze cost data.

This last responsibility should be considered a joint endeavor. The cost accountant should compute and arrange the cost data so as to quickly and definitely point out the "high cost spots." Together with the motion and time study engineer the high-cost causes and remedies should be determined and preventive or cost reduction measures put into effect.

The cost accountant is in an excellent position, furthermore, to help sell both top management and labor on the possibilities inherent in motion and time study work. If, in his cost reports and daily contacts, the cost accountant can convince the management that such work *should* be properly undertaken, and the employees that such work *will* be properly undertaken,— and both management and labor that such work *will always* be necessary, if the company is to survive and grow—then the cost accountant is rendering another essential service to his company.

Factors To Be Considered

(a) Attitude of Labor

A great deal of the labor unrest that we have been witnessing is directly traceable to inadequate consideration of labor's attitude

toward changes in management policy. The improper and abrupt introduction of motion and time studies in many factories has resulted in the common usage of such words as "regimentation," "speed-up," "slave-driver," "human machines," etc. Consequently, today, unions are demanding a greater voice and participation in the determination of the methods and standards of work. Today, workers want to be sure that the principles applied are sound and equitable. Very often they do not understand the necessity of this type of work. Because of earlier abuses, a strong antagonism has developed toward any study that may affect their wage rates.

Capable managements have recognized this situation and it is not unusual to hear of active union collaboration in motion and time study work. During the past year we have found plant employees in time study departments; union engineers making independent studies; in many cases mutually selected consultants engaged in setting standards of performance. Several plants have organized their own instruction programs and the techniques of motion and time studies are taught to groups of employees. These far-sighted measures have greatly enriched the quality of labor relations and general plant morale.

(b) Supervision

Such instruction programs cannot overlook another important link in management-labor relations, namely, the attitude and cooperation of supervision.

Executive attitudes and company policies are communicated to employees, and are usually interpreted for them, by their individual supervisors or foremen. Foremen, therefore, must sit in around the counsel table, be encouraged to express their opinion and be given every assurance that management is sincere and open-minded. We have obtained best results where foremen take an active part in motion and time study work, and for this reason encourage their participation.

(c) Facilities

In the process of creating a finished product, men alone cannot do the job. Adequate consideration must be given to the facilities and their relative productive capacity. Unless the plan and machinery have been carefully maintained, it is not advisable to at-

tempt motion and time analyses before an examination of the facilities is made and necessary improvements or repairs undertaken.

If management is undertaking a program of modernization, it is desirable to perform the broader "methods study" analysis preceding any detailed motion and time study work. This would involve:

1. Standardization of jigs, fixtures, equipment, etc.
2. Production scheduling (machine loading).
3. Working conditions.
4. Layout.
5. Materials handling.
6. Operation specifications.

Important Steps In Motion Study

Following the important preliminary work of "setting the scene" for the job, we come to the actual performance of motion study. In a search for correct motions these are essentially the steps to follow:

1. Construct a chart using symbols which will enable you to visualize the relationship of each movement or part of the operation in question. Are all the parts necessary?

2. Divide the entire work of the operator performing the job into simple elementary movements:—walk to tool room, get tools, return to machines, etc. Can any movements be shortened or eliminated?

3. Study each of the remaining steps, one after another, as performed by several operators. Here it is necessary to make a detailed analysis of motions pertaining to each of the hands. All hand work can be broken down into eighteen subdivisions, each referred to as a "therblig." Such operations as searching—either with eyes or the hands,—selecting, transporting, assembling, etc., are all considered "therbligs." As the study progresses, all unnecessary and useless steps should be eliminated or more effective motions substituted.

4. The experienced analyst will not hesitate to ask questions based upon certain fundamental laws of motion economy. These

cover such points as idleness, reaching, holding, rhythm of work, location of tools and parts, and other accepted principles.

5. Finally the motions which require the least effort, the least time, and produce the best results should be combined to give the nearest approach to an ideal performance. It is then essential that the operator be instructed and guided until he has developed proper work habits.

Important Steps in Time Study

Having convinced ourselves that the motions used in performing an operation are the most effective, the next important phase of analysis is to time the operations and establish basic data. The important steps are:

1. Analyzing the operation in order to determine the elements, or parts of the operation.
2. Timing each of these elements.
3. Rating the skill and effort of the operator.
4. Making allowances for factors beyond operator's control.
5. Setting standards based upon (1) to (4) above.

To date, the stop-watch is by far the most commonly used instrument in this procedure, although recently we have witnessed the development of the electric clock and the Marstochron, (an electrically operated tape on which marks are made to indicate time of each element). Progress and improvement is also being made in the techniques applied as well as in the tools employed. These changing techniques are rapidly increasing the acceptance of time study work.

At present a source of constant friction in time study is the modification of results to compensate for the degree of effort and speed shown by the operator during the study. Some of the methods that have been developed are known as: mathematical formulae, leveling, speed, effort or tempo rating. Unfortunately none of these have yet reached the degree of reliability where they can be applied with a certainty that the results will be universally accepted. Recognition of this problem has already been made by the Society for the Advancement of Management in appointing a

committee to explore the possibility of establishing uniform techniques for rating operators during time studies. We can expect some valuable data as a result of this committee's work.

Conclusion

In this present emergency, the need for speeding up the output of defense material has placed greater emphasis on this phase of industrial engineering. How can each defense operation be performed at a faster rate, and with less effort? What will be the production costs? When can we plan delivery? These are all vital questions which can be answered only if the cost accountant and the time study man work together and apply accepted techniques properly. As a direct result of our present emergency program there are four things clearly discernible:

1. More men will be trained to make motion and time studies.
2. The principles of motion economy will be applied more extensively to new jobs before put into operation.
3. There will be continued and outstanding improvement in the technique of making time studies and in the procedure used to determine resulting standards of performance.
4. Labor will accept the principles involved and will participate to a greater extent in this endeavor.

Those of us who seek to make more universal the acceptance of motion and time study principles were interested and encouraged by a recent news item. In an issue of *Business Week* appeared the announcement that The International Ladies' Garment Workers Union had launched its educational program for the twenty-fifth year, featuring a new course on production methods. In conjunction with this program a field staff gathers material on work habits, including time and motion studies for presentation to classes of its members. Here we can see, in reality, the acceptance of the principles and the willingness of labor to join management, and to mutually eliminate those causes which are inimical to their best interests. This joining of hands and meeting of minds cannot fail to answer the need of our present crisis and take us to a level of higher production, lower costs and a higher standard of living.

THE DESTRUCTION OF OLD RECORDS AS A WAR-TIME MEASURE

By Ernest A. Davis, Branch Auditor,
Pitney-Bowes Meter Co., Stamford, Conn.

THE PROBLEM of destroying records as soon as their real and contingent values expire is one which deserves a great deal more attention than it is receiving. Very few records have a value which extends beyond a brief period of time. When this subject does receive attention, it is usually from the viewpoint of retention. Since the item must eventually be destroyed, why not high-light the destruction factor?

Inactive records are potential waste paper. We know that there is a crying need for waste paper today. Inactive records fill steel file cases or cabinets. Under present priority conditions, the releasing of this equipment for active needs, is a helpful step in our victory effort. The substitution of wood or cardboard cases is not a fully satisfactory solution, and will not be until the Axis Powers have been weakened to the point where an incendiary air raid on our cities is an impossibility. This subject, therefore, takes its place as one of the many small but important war-time measures. Perhaps this factor has the necessary additional weight to bring the matter to general attention at this time.

Organization

The first step in handling the problem of record destruction is one of organization. The responsibility must be definitely delegated as a continuous assignment. Since we are dealing with a subject on which opinions will vary widely and on which no means of scientific determination may ordinarily be applied, it appears that a committee would best serve the purpose. Since definite decisions must be made, and concrete action taken, such a committee should number among its members at least one major executive of the company. The other members may be the head of the filing department and the heads of departments which have jurisdiction over large quantities of records. A committee of three or four should be large enough to bring in a range of differing

opinions, and yet small enough to avoid delay in extended discussions. Except during the initial period of planning and integration the demands on the time of these committee members should not be excessive.

The scope of this committee's responsibilities should be clearly stated. For the best results all records which are not in active daily use should be included, with the possible exception of the confidential records in the private files of executives. The records of an executive should surely be included if they extend beyond the filing space privately available to him, or if they become a major factor in his space requirements. A complete solution of the problem can only be reached when everyone from the President down lends active co-operation to the problem.

Definite Plan Necessary

The committee must lay out and then must follow some definite plan. This does not imply that a rigid routine must be set up and then slavishly followed. The plan must be elastic in form and must undergo constant revision in order to keep abreast of changing requirements. With no plan to guide its efforts, the committee would most certainly waste a great deal of time in aimless and futile gropings, owing to the extensive nature of the problem in an organization of even moderate size.

There are certain factors which should be a part of any well-laid record destruction plan:

1. A schedule of destruction dates which covers all records as far as possible.
2. Periodic checking and revising of this schedule.
3. Passing judgment promptly on items not covered by the schedule.
4. Provisions for the proper housing of records while they are retained.
5. Provisions for policing the committee's rulings.

Schedule of Destruction Dates

The preparation of a schedule of destruction dates is the most important undertaking of the committee. This will require a care-

ful study of the actual and contingent values of all inactive correspondence, forms and other records. Each item should be weighed with regard to its value to the particular business organization. Little attention should be given to the schedules of others, even in the same line of business. An intelligent solution of the problem should be possible within the organization and such outside factors may be misleading.

In evaluating a particular record, any claim as to benefits derived by having certain extremely old items available should be thoroughly examined. An attempt must be made to estimate the advantage in terms of dollars, rather than in personal satisfaction. Many apparent advantages do not show up well when given this test. It requires only simple arithmetic to show that, if $50 can be saved by having available one particular ten-year old record, and the cost of storing all records of the same nature for ten years amounts to $100, there is no real saving or advantage. If the records had been stored for five years, the saving in storage expense would exactly offset the advantage gained in having this one particular record available.

Employees who are active in a concern which has shifted its location a considerable distance will testify that when faced with the transportation cost of old records, radical revisions of opinions were made by those who are inclined to oppose the early destruction of any records.

Scheduling Destruction at Time of Organization

Many records, particularly correspondence, have no real or contingent value within a short time after their purposes have been consummated. Such items should be scheduled for destruction by the acting party at the very earliest date possible. If these items are not destroyed immediately after their purposes have been consummated, they may be placed in thirty- or sixty-day files. The valuable material, which should be retained for a greater length of time must be segregated. This can be done with the greatest efficiency if the filing status of each letter is immediately scheduled by the party who handles it.

Many large mail order houses return orders with the shipment of the items ordered. Against the possibility that they might render a service to some customer by keeping his order on file, they

have offset the certainty of filing expenses. The committee must be constantly alert to this condition. No record must be allowed to create filing expense, unless there is a strong probability that at least part of this expense will be recovered.

Setting Destruction Date for New Forms and Records

Once a schedule is established no new form or record should be created without providing for its destruction date. If a record adjudged to have a limited value for a short time, is to be set up, a thorough job of planning provides a time and a method for destroying it. While this seems to be a logical assumption, it is definitely true that in the majority of plans for new routines, forms are set up, detailed procedure for their proper use is laid out, and then as in fairy stories, the idea that they will all live happily ever after may be inferred.

No decision with regard to destroying a record should be made without asking the opinion of the department head who is vitally concerned; but too much weight to such opinions should not be given since the department heads all too frequently favor extensive retention of all records. Similarly, the opinions of the legal department should be asked; but except where statutes provide that certain records must be retained, this opinion must be considered as merely another opinion which is not to be overweighed. The committee should evaluate all available opinions in reaching a final decision.

Elimination of Duplicate Copies and Summaries

Fullest consideration must be given to the number of copies of a record which are included in the file. With each department head meeting his own requirements, a business will almost certainly be maintaining duplicates or even more numerous copies of records which are nearly identical. After the necessary co-ordination work by the committee, it will in most cases be possible to dispose of all but one copy and still meet the requirements of all who are concerned.

Certain records are summarized, and the records and their summaries both find their way into the file. When the nature and value of these records are determined, it may be found that either the summary or the detailed records should be maintained for a

considerable period, but that the retention of the alternate is useless. This factor is another element of duplication. Such duplication is a matter which will require the constant alertness of the committee, if it is to be universally detected.

Cost of Maintaining Records

Having set up a destruction schedule, the committee must give due consideration to the cost of maintaining records from the time they become inactive until the date of their destruction. This cost will include the following elements:

1. Floor space
2. Equipment
3. Fire protection
4. Clerical handling
5. Transportation

Probably the easiest method of securing the co-operation of all department heads and officials in holding down the quantity of records retained, is to set up a standard cost per filing cabinet drawer or per cubic foot of shelf space, and to directly charge each department with the maintenance cost of its own records. This constantly recurring expense will concretely show that an occasional moderate-sized loss, caused by the failure to produce a certain required record, may be readily offset by the expense entailed in maintaining all the records of a similar nature for the extended period required.

There are organizations located in small towns near the metropolitan district which make a business of maintaining archives for concerns which are cramped for space or which are located in areas where the cost value of a square foot of floor space is excessive. Such an organization may be of help to a business which has adequate facilities provided for normal requirements but which meets some unusual requirements which is of a temporary nature. Since these organizations maintain the records in a readily accessible manner, any required information may be easily obtained by use of the telephone. If records which are not likely to be used frequently are retained, they should be packed in a manner which

makes them less readily available; this results in a much lower cost of dead storage.

Items Included in Cost

When the company maintains its own archives, the cost of equipment such as filing cabinets, index cards, etc., must be determined. To this the cost of fire protection for this equipment and the records must be added. The clerical work of transferring records and changing the index cards must also be included. In some cases the time of one or more employees may be required to maintain the records in good order and to answer phone calls or written requests for information. If the archives are not staffed, the committee should make some arrangement for policing the department, since carelessness on the part of some employee may upset the careful planning which has been applied. When the records cannot be maintained at a point readily available to all departments, the cost of transportation to the archives may become an important factor. In addition, the cost of time used in going to the archives, and in searching for material must be included. Proper evaluation of this cost may show that the most economical method is to staff the archives. This department is merely an extension of the central filing department. Therefore, it appears that some provision for continuous clerical handling would be the most efficient method in an organization of any size.

Use of Photographic Methods

In many business organizations the cost of maintaining records can be greatly reduced by the application of modern photographic methods. There are several devices on the market for rapidly photographing records on a running strip of film. These photographs are greatly reduced in size and some sort of apparatus is required in order to project the record in readable form. Banks are making extensive use of this procedure at the present time. The advantages are the small amount of space required for storage, the reduced cost of filing equipment, the reduced cost of clerical handling, the availability of the records on the spot (which is an off-shoot of the reduced storage space factor) and the permanent binding of groups of records in the order photographed (since the film is developed and retained in rolled form). The original

records may be retained until the developed film is ready for reference, so that the temporary absence of the film during its development process is not a factor. Before making a decision with reference to this photographic method, it might be advisable for the committee to have an opinion from the legal department as to the acceptance of such photographs as evidence in a court of law. The opinion requested should be with regard to the particular records and the nature of the company's business, rather than a general opinion on the subject. It may be their opinion that with certain records, the photographic method would be acceptable, whereas specific legal requirements would preclude its use in connection with other records.

Execution of the Plan

The schedule having been set up in accordance with the above factors, the committee should turn its efforts to the execution of its plans. With regard to the records retained, space must be provided for current requirements and for normal expansion. If the company is in a period of general business expansion, the maintaining of certain records for six years may involve a constant increase in demands for space. Adequate equipment must be provided. Some records must be provided with storage facilities which will permit ready reference, while others may be merely stored for a period of time, little or no reference being likely.

The destruction schedule, when set up and approved, must be put into effect. Provisions must be made as to the time and the method of removing the records from the files or containers. Due thought must be given to the possibility that certain records which have no further value to the organization, might be the cause of considerable trouble or embarrassment if they came into the hands of an unscrupulous competitor. Some provision must be made for the burning or other effective destruction of any such records by making arrangements with a reputable firm; however, it should be possible to sell most of the records as waste paper.

Policing the Execution of the Plan

Having followed the plan to this stage, the committee will have successfully started the task assigned. Provisions must be made for regular frequent meetings to pass on new questions which

may arise, to interpret borderline cases, and to frequently review the schedule, as well as all other factors in the plan of procedure. A plan which is not constantly reviewed will start to lose its effectiveness at a surprisingly early date.

The committee must investigate the various steps in the execution of its plan and must provide some means of definitely assuring itself and the executive to whom it is responsible that all factors are in operation, that the details are fully understood by those who have duties to perform, and that the constant excuse of being too busy is not permitted to prevent the taking of action at the required time.

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